DU’s authentic and innovative approach to carbon neutrality

JAMES ROSNER, P.E., C.E.M.
ASSOCIATE VICE CHANCELLOR

LYNN BAILEY, P.E., C.E.M.
ASSISTANT DIRECTOR
Learning Outcomes

- Utilization of utility budgets to fund energy savings projects
- Use of energy projects and renewable energy to meet GHG reduction goals
- Use of power purchase agreements to fund renewable energy projects
Overview

- University of Denver Campus Overview
- Energy and GHG Goals
- Utility Reserve Fund Structure and Results
- Green Fund Structure
- Carbon Neutrality Results
- Renewable Energy Challenges on Campus
- Power Purchase Agreement Process and Structure
- Next Steps
Campus Overview

- Founded in 1864 as Colorado Seminary in then the Colorado Territory
- Great Private University dedicated to the Public Good
- 3.8 million square feet over 125 acres in the City of Denver
- 11,500 students & 3,800 staff/faculty
- Campus is a working Arboretum
- 5 Portfolio Building Categories:
  - Millennium, Legacy, Beneficial, Transition, Rental
  - Adding 6th Category: Advantage
- 18 of 88 Buildings on Central Plant (Sturm Hall)
Campus Age Profile Over Time

72% of campus has less than a 25-year renovation age
Energy and GHG Goals

- Carbon Neutrality by 2050
  - 24% reduction by 2020, from 2006 baseline
  - 45% reduction by 2025, from 2006 baseline
- Reduction of 500,000 in kWh annually
- 5-year payback for energy projects
- 5% on-site/20% off-site renewable energy production by 2025
Utility Reserve Fund Structure

- Fund established in 2009
- Initially seeded at $1.9M
- Energy conservation projects
- Payback < 5 years required
- Revolving fund 2009 – 2016
Utility Reserve Fund Results

<table>
<thead>
<tr>
<th>Energy Saving Projects - Cumulative Q2 FY19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Controls</td>
</tr>
<tr>
<td>Lighting</td>
</tr>
<tr>
<td>Mechanical</td>
</tr>
<tr>
<td>Survey</td>
</tr>
<tr>
<td>Totals</td>
</tr>
</tbody>
</table>

<p>| FY19 - Completed or In Progress | |
|--------------------------------|---|----------------|---------------|------------------------------|----------------------|</p>
<table>
<thead>
<tr>
<th>Type</th>
<th>#</th>
<th>Construction Cost</th>
<th>Less Rebates</th>
<th>Net Investment</th>
<th>Annual Savings (FY17 Rates)</th>
<th>Average Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>2</td>
<td>$491,415</td>
<td>$(70,240)</td>
<td>$421,175</td>
<td>2,034,730 $ 183,125</td>
<td>2.30</td>
</tr>
<tr>
<td>Mechanical</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>2</td>
<td>$491,415</td>
<td>$(70,240)</td>
<td>$421,175</td>
<td>2,034,730 $ 183,125</td>
<td>2.30</td>
</tr>
</tbody>
</table>

**Cumulative** | **83** | **$3,131,989** | **($995,862)** | **$2,136,127** | **118,968** | **9,510,932** | **918,385** | **2.33** |

**Analysis:** Energy saving projects for FY19 will yield a 2.3 year payback, with a cumulative payback of 2.33 years.
Campus Electrical Consumption

Average electrical consumption reduction 692,000 kWh annually, 2006–2018
Utility Reserve Fund Balance

<table>
<thead>
<tr>
<th></th>
<th>FY09</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
<th>FY19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance</td>
<td>1,939,148</td>
<td>4,168,793</td>
<td>5,403,961</td>
<td>6,020,367</td>
<td>4,582,984</td>
<td>4,623,964</td>
<td>3,487,514</td>
<td>5,312,775</td>
<td>5,500,446</td>
<td>4,839,129</td>
<td>4,024,974</td>
</tr>
</tbody>
</table>
Green Fund Structure

- Utility Reserve Fund reassignment to Green Fund in 2017
- Energy and sustainability initiatives
- Revolving fund changed to fixed annual investment
- Payback increased to 10 years
- Ability to contribute $1.69M to LEED goals for Capital Projects
Carbon Neutrality Results

Total Net Emissions Over Time

38% reduction in net emissions

Net MTCDE:
- FY2006: 70,856
- FY2007: 61,075
- FY2008: 60,115
- FY2009: 57,184
- FY2010: 54,586
- FY2011: 54,928
- FY2012: 50,465
- FY2013: 47,402
- FY2014: 45,560
- FY2015: 45,198
- FY2016: 43,678
- FY2017: 45,358
- FY2018: 43,985

Scope 1  Scope 2  Scope 3
Carbon Neutrality Results

Change in Emissions by Scope from Baseline
Indexed to FY2006

- FTE change: +7%
- GSF change: +8%
- MTCDE change: -38%
Renewable Energy Challenges

- DU wasn’t participating in any renewable energy programs
- Overcoming memory of early renewable investigation
- Limited campus and site availability
- Campus architecture and aesthetics
- Unfamiliarity with PPA structures
- On-site only a fraction of total need/load
- Timing with tax incentives and tariffs

What changed? Student advocacy and demand tipped the scale
Solar PPA Process

Oct 2017
- Colorado State University RFP
- Joined as Voting Member
- On and Off site

Apr - Jun 2018
- BOT Task Force
- Approval to begin negotiations
- On-site only

Dec 2018
- Contract Signed
- 20-yr PPA
- 2.2 MW
- 18 Buildings

Jan - Mar 2018
- Interviews
- Selection
- BOT presentation

Jul - Nov 2018
- Due Diligence
- Due Diligence
- Legal Review

Jan - Jun 2018
- Final Design
- Interconnection Agreement
- Permitting
Power Purchase Agreement Structure

**Power Purchase Agreement (PPA)**

Pivot Energy is the PPA provider and manages the ownership, financing, installation, and maintenance of the rooftop solar energy systems across the DU campus over the 20-year term of the agreement.

**Utility**

Xcel Energy continues to produce and supply electricity transferred through its electric grid.

Any excess power (electricity that is not being used) is sent back to Xcel Energy's electric grid, further reducing your utility bill.

During the evening, when the sun is gone, you will draw energy from Xcel Energy's electric grid, so you are never without power.

**Solar PV Systems**

The photovoltaic (PV) solar arrays are installed on 18 rooftops across campus with no upfront cost. The systems convert light from the sun into electricity for your facilities and will offset 7-8% of total campus electricity use.

**University of Denver**

DU pays Pivot Energy for the solar power produced oftentimes at a cheaper rate, resulting in savings. Additionally, DU will own 100% of the Renewable Energy Credits (RECs) produced by the systems, thereby reducing DU’s carbon footprint by 3-4%.
<table>
<thead>
<tr>
<th>Solar Locations</th>
<th>2019/2020 Project Completion</th>
<th>kW Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ritchie Center</td>
<td>748.11</td>
<td></td>
</tr>
<tr>
<td>Hampden Center</td>
<td>229.02</td>
<td></td>
</tr>
<tr>
<td>Anderson Academic Commons</td>
<td>189.09</td>
<td></td>
</tr>
<tr>
<td>Sturm Hall</td>
<td>116.16</td>
<td></td>
</tr>
<tr>
<td>Schwayder Art</td>
<td>54.87</td>
<td></td>
</tr>
<tr>
<td>UTS</td>
<td>26.4</td>
<td></td>
</tr>
<tr>
<td>Fisher Early Learning Center</td>
<td>19.8</td>
<td></td>
</tr>
<tr>
<td>Frontier Hall</td>
<td>56.76</td>
<td></td>
</tr>
<tr>
<td>Seeley Mudd</td>
<td>91.41</td>
<td></td>
</tr>
<tr>
<td>Boettcher West</td>
<td>154.77</td>
<td></td>
</tr>
<tr>
<td>Knudson Hall</td>
<td>26.4</td>
<td></td>
</tr>
<tr>
<td>Ammi Hyde</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Central Receiving</td>
<td>26.4</td>
<td></td>
</tr>
<tr>
<td>Cherrington Hall</td>
<td>41.25</td>
<td></td>
</tr>
<tr>
<td>AOB</td>
<td>49.83</td>
<td></td>
</tr>
<tr>
<td>Driscoll South</td>
<td>109.56</td>
<td></td>
</tr>
<tr>
<td><strong>2019 TOTAL</strong></td>
<td><strong>1972.83</strong></td>
<td></td>
</tr>
</tbody>
</table>

| All Sites | **2101.03** |

<table>
<thead>
<tr>
<th>2020 Project Completion</th>
<th>kW Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career Achievement Center</td>
<td>62.7</td>
</tr>
<tr>
<td>First Year Residence Hall</td>
<td>65.5</td>
</tr>
<tr>
<td><strong>2020 TOTAL</strong></td>
<td><strong>128.2</strong></td>
</tr>
</tbody>
</table>

| All Sites | **2101.03** |
Solar Tree
Rooftop Solar
Installation

Knudson Hall
Next Steps

- Complete Solar PPA Project – 3-4% GHG reduction
- File for REC ownership
- Not pursuing off-site PPA – Xcel Energy commitment to carbon neutrality by 2050
- Address Scope 1 and 3 emissions
  - Natural gas consumption
  - Travel
  - Commuting
- Campus Growth: 3 new buildings (285,000 GSF) coming on-line in 2020
- Energy Master Plan for pathway to carbon neutrality
  - Student Government just passed a resolution for neutrality by 2030
Proposed Campus

Graduate / Faculty / Market Rate Housing
Undergraduate Student Housing
Athletics / Sport Medicine
Academic
Hotel
Retail
Parking Garage
Community Centers
Office / Clinic / Innovation
Ricks Center
Questions